DOCUMENT RESUME

ED 387 191 JC 950 495

AUTHOR Boughan, Karl; Clagett, Craig A.
TITLE A Student Outcomes Typology for Community Colleges: Identifying Achievers with Longitudinal Cohort Analysis.
PUB DATE 30 Oct 95
NOTE 16p.; Paper presented at the Annual Conference of the North East Association for Institutional Research (22nd, Burlington, VA, October 30, 1995).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; Cohort Analysis; Community Colleges; Longitudinal Studies; *Outcomes of Education; *Predictor Variables; *Student Characteristics; Two Year Colleges; *Two Year College Students
IDENTIFIERS Prince Georges Community College MD

ABSTRACT

A study was conducted by Prince George's Community College, in Maryland, to determine outcomes after 4 years for the 2,643 first-time students who entered the college in fall 1990. The analysis was based on an outcomes typology developed at the college which defines outcomes as award and transfer; transfer without an award; award without transfer; sophomore status with at least a 2.0 grade point average (GPA); achievers (i.e., a summary of the preceding four categories); still enrolled; dropouts; or other special motive students. Outcomes for the fall 1990 cohort were then determined by ethnicity, gender, attendance patterns, the need for developmental education, and academic characteristics. Study results included the following: (1) for the 2,387 of fall 1990 degree-seeking students, 28% were categorized as achievers after 4 years, with 137 earning a degree, 214 transferring, and 314 achieving sophomores status; (2) Asian-Americans, White-Americans, and international students reached achiever status at higher rates than African-American and Hispanic-American students; (3) 54% of the students who attended their first 3 terms attained achiever status, compared to 22% of those who attended 3 or more terms but did not enroll in all of the first three major terms and 4% of those who attended 1 or 2 terms; (4) only 11% of the students who needed remediation in mathematics and at least one other area were classified as achievers, compared to 44% of students who needed no remediation; and (5) two important factors related to attaining achiever status were enrolling in any summer session and any change of major. (KP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 387 191

A Student Outcomes Typology for Community Colleges: Identifying Achievers with Longitudinal Cohort Analysis

Karl Boughan
Supervisor of Institutional Research

Craig A. Clagett
Director of Institutional Research and Analysis

Prince George's Community College
301 Largo Road K-231
Largo, Maryland 20774

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
C. Clagett

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Paper presented at the 22nd Annual Conference of the
North East Association for Institutional Research

Burlington, Vermont
October 30, 1995

JC 950 495

BEST COPY AVAILABLE

A Student Outcomes Typology for Community Colleges: Identifying Achievers with Longitudinal Cohort Analysis

Karl Boughan
Supervisor of Institutional Research

Craig A. Clagett
Director of Institutional Research and Analysis
Prince George's Community College

Governmental and accrediting agencies, college guidebook publishers, and others have focused on college graduation rates as a primary accountability measure. At open-admissions community colleges, with large proportions of students attending part-time, having goals other than degree completion, and needing remediation, such rates are often quite low. In addition, many students with goals of baccalaureate degrees transfer to senior institutions prior to completion of their community college programs. "Leaving early" for a senior institution does not represent a community college retention failure but often a rational advancement toward the student's ultimate goal. Community college assessment measures that focus exclusively on graduation rates are misleading, as is increasingly recognized. For example, transfer to "a higher level program for which the prior program provided substantial preparation" has been included as a "completion" in Student-Right-to-Know calculations.

Inclusion of transfer in summary outcomes measures is not sufficient, however. What is needed is an outcomes typology that (1) is comprehensible and accepted as legitimate by legislators, accrediting agencies, the public, and all others colleges are appropriately accountable to; (2) takes into account the full range of student goals in attending college; (3) acknowledges student enrollment behavior patterns, including part-time and stop-out attendance; and (4) provides a meaningful summary of student accomplishment that is useful to campus policymakers. The research office at Prince George's Community College developed the following student outcomes typology for both external accountability and internal decision support:

1. **Award and transfer.** The percentage of degree-seeking students in an entering cohort who have earned a degree or certificate from the community college *and* transferred to a four-year college or university within the study period. Depending on how the transfer information is obtained, transfer rates may be underestimated. This is likely for colleges relying on state reporting systems since student transfer to independent colleges or colleges outside the state are often not including in state-mandated reporting systems.

2. **Transfer/no award.** The percentage of degree-seeking students identified as transferring to a senior institution without having earned an award from the community college.

3. **Award/no transfer.** The percentage of degree-seeking students earning a degree or certificate from the community college for whom there is no evidence of transfer.

4. **Sophomore status in good standing.** The percentage of degree-seeking students who have not graduated from the community college but who have earned at least 30 credits with a cumulative grade point average of 2.0 or above, and for whom we have no evidence of transfer. Given the large proportions of entering students needing remediation and/or attending part-time, reaching sophomore status in good standing represents a notable academic achievement. Probably included in this category are a number of students who have transferred to independent and out-of-state colleges or universities.

5. **Achievers.** A summary measure of the preceding four categories.

6. **Persisters.** The percentage of degree-seeking students still enrolled at the community college (as of the last term of the study period) who do not fall into any of the above "achiever" categories. They have not graduated or transferred, nor have they earned 30 credits with a 2.0 grade point average. Their outcomes are yet to be determined.

7. **Other exiters.** The percentage of degree-seeking students exiting the community college without graduating or earning 30 credits in good standing for which we have no evidence of transfer. Included in this group are the true "dropouts" who have not succeeded in reaching their goals within the study period. Some of these students may have transferred early (before accumulating 30 credits) to independent or out-of-state colleges, but most students in this group are appropriately considered as unsuccessful in achieving their academic goals at the college.

8. **Special motive.** Students who had indicated short-term, non-degree goals of personal enrichment or job skill upgrading *and* who attended only during the first two terms of the study period. Never intending to enter a curriculum or transfer, these students are properly excluded from attrition statistics.

The above classification becomes most meaningful when a substantial majority of the cohort has attained their ultimate community college outcome.

While this argues for a fairly long study period, say six years or more, another consideration supports a shorter time span. Reporting on cohorts that entered many years ago runs the risk that student characteristics and institutional practices may have changed, so that the findings may not be useful guides for current policymaking. At PGCC, students are classified according to the typology at the end of three, four, five, and six years, with the four-year analysis included in reports to our Board of Trustees and our state higher education commission. Four-year outcomes for the fall 1990 cohort are reported in this paper.

A total of 2,643 first-time students entered the college in fall 1990. Of these, 256 indicated they had no intention of earning credits toward a degree, but instead were enrolled for short-term enrichment or specific skill upgrading reasons. Among the 2,387 degree-seeking students, 137 or less than 6 percent had earned an award from PGCC by the end of spring 1994. Another 214 (or 9 percent) had transferred to a four-year public college in Maryland. Thus 351 or nearly 15 percent had earned a degree or transferred within four years of entering the community college. An additional 314 students, or 13 percent, had earned at least 30 credits at PGCC with a cumulative grade point average of 2.0 or above. Including these sophomores in good standing with the graduates and transfers, the total proportion of fall 1990 entrants classified as achievers within four years was 28 percent.

Student Outcomes After Four Years
Outcomes as of the End of Spring 1994 of Students Entering in Fall 1990

Outcome	Number	Percent
Award and Transfer	54	2%
Transfer, No Award	214	9%
Award, No Transfer	83	4%
Sophomore w/2.0+ GPA	314	13%
Achievers	665	28%
Enrolled Spr 94 <30 Credits/ 2.0	175	7%
Dropouts	1,547	65%
Total Degree-Seeking Students	2,387	100%
Special Motive (excluded from above)	256	–

These outcome patterns varied by race/ethnicity, with Asian-Americans, white Americans, and international students achieving at higher rates than African-Americans and Hispanic-Americans. African-American and white students

accounted for nearly nine in ten students in the cohort; their four-year outcomes are displayed below. White females had relatively high achievement levels. Forty-two percent of the white women had either graduated, transferred, or attained sophomore status in good standing within four years of entry to PGCC. This was slightly better than the white men, 38 percent of whom were classified as achievers according to the typology. In contrast, the achievement rates of African-American men and women were lower. Nineteen percent of the African-American women were classified as achievers. Only 13 percent of the African-American men had graduated, transferred, or attained sophomore status in good standing within four years.

Student Outcomes After Four Years, by Race/Ethnicity and Sex
Outcomes as of the End of Spring 1994 of Students Entering in Fall 1990

Outcome	African American Males	African American Females	White American Males	White American Females
Award and Transfer	1%	1%	4%	4%
Transfer, No Award	4%	4%	15%	15%
Award, No Transfer	2%	3%	3%	7%
Sophomore w/2.0+ GPA	6%	11%	16%	17%
Achievers	13%	19%	38%	42%
Enrolled Spr 94 <30 Credits/2.0	7%	10%	5%	5%
Dropouts	79%	71%	57%	53%
Total Degree-Seeking (100%)	463	718	400	496
Special Motive (excluded above)	30	88	40	73

The next step in the longitudinal cohort analysis involved an examination of student patterns of attendance, to see if they were associated with student outcomes four years after entry. As expected, students attending in fall 1990 and at most only one other term were unlikely to attain achiever status as defined in the OIRA typology. Only four percent of these short-term attenders were classified as achievers, almost all through early transfer to a senior institution in Maryland. Among those students attending at least three terms, however, a substantial difference was found. Students who attended the first three major terms (fall 1990, spring 1991, and fall 1991) were more than twice as likely to be achievers than students who were absent in either the spring or fall of 1991. A majority of those getting off to a "good start" had graduated, transferred, or attained sophomore status in good standing within four years of entry, compared

to only 22 percent of those who attended three or more terms but did not enroll in all of the first three major terms. Students with the "good start" attendance pattern of enrolling in at least the first three terms without interruption had higher rates of graduation, transfer, and sophomore attainment:

Outcomes After Four Years, by Attendance Pattern
Degree-seeking Students Entering in Fall 1990

Outcome	"Good Start" (First 3 Terms)	3 or More Other Terms	1 or 2 Terms
Award and Transfer	5%	1%	0%
Transfer, No Award	16%	5%	4%
Award, No Transfer	7%	4%	0%
Sophomore w/2.0+ GPA	26%	13%	<1%
Achievers	54%	22%	4%
Enrolled Spr 94 <30 Credits/2.0	8%	23%	2%
Dropouts	38%	55%	94%
Total Degree-Seeking (100%)	1,030	309	1,048

The last component of this initial use of the longitudinal outcomes typology was to examine the impact of the need for remediation on four-year outcomes. Earlier OIRA studies had found that mathematics ability was a key predictor of success, a finding consistent with much national literature. Exploratory studies at PGCC had suggested that students needing remediation in mathematics and at least one other area — reading or English composition or both — were at greatest risk of not succeeding. This proved true for the fall 1990 cohort. Only 11 percent of the students identified as needing developmental courses in mathematics and at least one other area were classified as achievers after four years. In contrast, students with no developmental needs achieved at a rate of 44 percent. Adding in persisters — students enrolled at PGCC the last term of the study period — found half of the students not needing remediation successful, compared to only 20 percent of the "developmental math plus" group. Among full-time students, 56 percent of the non-developmental group — compared to 17 percent of the developmental math plus group — had graduated, transferred, or attained sophomore status in good standing within four years.

Student Outcomes After Four Years, by Developmental Need Outcomes as of the End of Spring 1994 of Students Entering in Fall 1990				
	No Developmental Needed		Developmental Math Plus	
Outcome	Total	Full-time	Total	Full-time
Award and Transfer	4%	7%	<1%	1%
Transfer, No Award	17%	24%	2%	4%
Award, No Transfer	5%	6%	1%	2%
Sophomore w/2.0+ GPA	18%	19%	7%	9%
Achievers	44%	56%	11%	17%
Enrolled Spr 94 <30 Credits/2.0	6%	4%	9%	7%
Dropouts	50%	40%	80%	76%
Total Degree-Seeking (100%)	949	536	628	281

Achievement rates were calculated for several academic variables, each of which appeared to be associated with student success. The more terms a student attended, and the more credits carried each term, the higher the achievement. Students who attended without interruption had higher achievement rates than students who interrupted their studies. And students who were always in good academic standing had higher achievement rates than those who attended one or more terms on academic probation or restriction.

The table below shows the achievement rates of various cohort sub-samples defined by single variables individually. But in reality, the factors inhibiting or facilitating academic success are cumulative and interactive. One way to see this is to create a new table that shows the achievement rates of successive sub-samples created by adding criteria one at a time, steadily decreasing the size of the sample by more narrowly defining it. Beginning with the total degree-seeking cohort of 2,387 students, that collectively generated a 28 percent achievement rate, the addition of each additional criterion raised the achievement rate substantially. The sub-sample of all full-time degree-seeking students, accounting for a third of the total cohort, had an achievement rate of 45 percent. Nearly three-fifths of the full-timers who were tested and did not need remediation had graduated, transferred, or achieved sophomore status in good standing.

Percent Achievers, by Academic Characteristics			
Student Characteristics	Number of Students	Percent of Cohort	Percent Achievers
Mean Credit Load 15 +	104	4%	59%
12 - 14 Credit Hours	669	28%	43%
9 - 11 Credit Hours	558	23%	37%
6 - 8 Credit Hours	544	23%	19%
< 6 Credit Hours	512	21%	4%
No Remediation Needed	949	40%	44%
Remediation Required	1,249	52%	19%
Not Assessed	189	8%	10%
Attended 7 - 8 Major Terms	276	12%	72%
5 - 6 Terms	440	18%	55%
3 - 4 Terms	623	26%	31%
1 - 2 Terms	1,048	44%	4%
Continuous Enrollment	809	34%	58%
Interrupted Enrollment	1,578	66%	13%
Always in Good Standing	849	36%	58%
At Least One Term not G.S.	1,538	64%	12%

The achievement rates for each successive sub-sample, and the number and percent of students represented, were as follows:

Percent Achievers, by Cumulative Academic Characteristics			
Cumulative Criteria Sub-samples	Number of Students	Percent of Cohort	Percent Achievers
All degree-seeking students	2,387	100%	28%
▸Mean term credit load 12 +	773	32%	45%
▸No remediation required	414	17%	59%
▸Attended 3 + major terms	249	11%	83%
▸Continuously enrolled	194	8%	90%
▸Always in good standing	169	7%	96%

Ninety-six percent of the cohort degree-seekers who attended full-time, had college-level basic skills at entry, attended three or more terms without interruption, and were always in good academic standing, succeeded according to our definition. For those students who came to the college with an adequate academic background, were able to make a commitment to full-time, uninterrupted study, and who studied sufficiently to earn passing grades, success

was almost certain. The explanation for the poor overall achievement rates at PGCC is that so few of the college's students fit this profile.

How did all of the correlates of academic outcomes just discussed work together to predict student achievement? To answer this question requires some form of multivariate analysis which can identify and separate robust indicators from those whose predictive power is only a product of spurious correlation. The method chosen for our multivariate analysis of 1990 Cohort four year academic achievement was *logistical regression*. This technique was specifically developed to handle situations like ours where the analyst must model the collective impact of a set of category independent variables upon a dependent variable taking 0/1-indicator or flag form. In this case, standard linear regression is precluded because variable distributions are inherently non-normal.

The output of a logistical regression is a linear regression-like equation. The equation's b-coefficients, when multiplied by their respective variable category values and then summed, produce a natural log-based statistic (Z^2), the antilog of which is an estimate of the overall probability of a case falling into the indicator classification. These estimates of classification probability can be used to assign cases to their most likely dependent variable category. (For example, applying our data and the normal cut criterion of ≥.5, a student with a classification probability of .65 would be assigned to the achiever category, if .49 to the non-achiever category.) Comparison of predicted and actual dependent variable case classifications can then be made and predictive accuracy straight-forwardly expressed in terms of percent of cases correctly placed by the model.

As in standard regression analysis, selection of independent variables for the logistic regression equation can be carried out using forward inclusion procedures based on the statistically significant predictive weight each tested variable may contribute to the accumulating total. However, where forward standard regression proceeds according to *continuous* variable addition to total R^2, forward logistical regression selects *category* variables according to the amount each would add to the preceding joint Chi^2. A statistical significance test of each variable inclusion step, as well as for the resulting full logistic equation, is possible, and various goodness-of-fit statistics, based on a probability measure known as the likelihood statistic (or *-2LL*), are available for estimating the overall power of the model. Finally, the typical logistical regression analysis generates an association coefficient called *R*, analogous to the Pearson part-correlation of linear regression, for gauging each equation variable's singular contribution to the model.

In preparing for the logistical regression analysis, we selected 58 independent variables for trial inclusion representing all of the forces we

hypothesized might condition academic progress at PGCC for which we had indicators:

- *Social Background* (Age, Sex, Race/Ethnicity, Socio-Economic Status, etc.)
- *Entry Condition* (Immediate Entry from High School, Type of High School.)
- *Attendance Location/Schedule* (Main Campus or Extension Centers, Day, Evening or Weekend Classes, etc.)
- *Study Objectives* (Transfer, Degree, Job-Related, Self-Enrichment, etc.)
- *Study Curriculum* (Transfer or Occupational Program, Specific Major, etc.)
- *Remediation Status* (Placement Test, Number of Developmental Areas Required, Program Completion, etc.)
- *Course Effort* (Credit Hour Load, Summer Attendance, etc.)
- *Course Performance* (Cumulative GPA, Academic Standing, etc.)

The social background battery was particularly rich due to the inclusion of a set of 12 items relating student neighborhood of residence to U.S. Census data on annual household income, percent of college graduates, upper white collar employment, official poverty rate and the like. Variables having to do with credit accumulation (Number of Major Terms Attended, Four Year Cumulative Credit Hours Earned) were deliberately excluded from the equation since credit accumulation success is a dimension of the dependent variable (e.g., 30 or better credit hours earned). Indicators of the "good start" phenomenon and non-interrupted attendance generally also were not tested here, in this case because of a problem in variable definition: to make any sense of the concept, assessing continuity of study requires a study interval of at least three major terms and therefore can only be carried out on a cohort subsample consisting exclusively of post-Term 2 students. The results of our logistical regression are summarized in the table below.

The overall model seemed to show good technical goodness-of-fit, which is measured in logistical regression by a comparison of the -2 Log Likelihood before variable inclusion with the *-2LL* after model building is complete. Perfect "fit" would be represented by a model with 0 *-2LL*. Our model represented a considerable -2LL drop of 1554 down from a pre-model figure of 2837, statistically significant at the $p < .0000$ level. Furthermore, the logistic model seems to possess a striking power of predictiveness, correctly classifying 87 percent of degree-seeking cohort students into their proper academic achievement categories – an improvement of 75 percent over coin flipping results and an increase of 55 percent over guessing the known mode in every case.

We attempted to corroborate the logistic model by running the same data through linear regression and discriminant analyses. Even though these methods were technically less appropriate given the level of measurement of our variables,

Logistical Regression Model of Four Year Student Achievement
Data Source: Fall 1990 Cohort of PGCC First Time Entrants (N = 2,387)

Statistics for Whole Model

Intercept Only -2 Log Likelihood	2836.95
Full Model -2 Log Likelihood	1282.87
Full Model Chi^2	1554.07 (df = 13) .0000 Significance
Step Improvement Chi^2	4.33 (df = 1) .0374 Significance

Model Equation Statistics

Independent Variable	Entry Step	Added Chi^2	*b* Signif.	*R* Partial Corr	Raw *Eta* Corr
Cum. Grade Point Average (4 Yr)	3	226.8	.0000	.250	.560
Summer Session - Any (4 Yr)	2	333.3	.0000	.213	.443
Curriculum Change - Any (4 Yr)	5	89.6	.0000	.156	.281
Acad Good Standing - Always (4 Yr)	6	47.3	.0000	.125	.462
Avr Credit Load - Major Term (4 Yr)	4	253.3	.0000	.103	.361
Remediation Completed - All (4 Yr)	10	5.0	.0021	.051	.112
Avr Credit Load (T1-T2)	8	11.9	.0039	.047	.356
Dev. Course-Taking - Any (T1-T2)	11	7.2	.0052	-.045	.196
No Curriculum Choice (4 Yr)	9	8.3	.0092	-.041	.125
Acad Good Standing (T1)	1	529.1	.0174	.036	.466
Immediate Entry from H.S. (T1)	7	33.4	.0196	.035	.188
New Collar Programs (4 Yr)	12	4.7	.0220	.034	.115
Under 21 Yrs Old (T1)	13	4.3	.0372	.029	.191

Predicted vs. Actual Case Classification

	Model Predicted		
Actual Outcome	Non-Achiever	Achiever	% Correct
Non-Achiever	1,590	125	92.7
Achiever	175	497	74.0

Overall Percent Correct Classification	87.4
Proportional Improvement over .5 Chance	74.8
Proportional Improv over Marginal Guessing	55.3

NOTE: All multivariate analyses were run on a dataset which excluded special motive student and was updated through summer session 1994.

we felt that their approach to model building and underlying mathematics were close enough so that similar results ought to be obtained if the logistic model was valid. This proved to be the case: the variable components of linear and discriminant models, and their relative proportional contributions, were nearly identical to those in the logistic model. The linear model's goodness-of-fit, as measured by Pearson's R^2, was 47 percent of the total variance explained, while the discriminant model (mathematically equivalent to the linear model when, as here, the dependent variable is a dichotomous indicator) correctly identified the achievement categories of 86 percent of the cohort's members.

More interesting, of course, is the structure of the model itself: Which variables made it into the equation (and which did not), and how much explanatory power did each included variable possess relative to the others? The first question is easily answered by comparing the lists of researcher-entered and model-included variables. The hard task in regression analysis, logistical regression not excepted, is always the assessment of relative variable contributive weights. Setting aside issues of collinearity (high variable inter-correlations) for the moment, this is true because contributive "weight" can mean several different things, each measured by a different variable-specific statistic.

In logistic regression, for example, the *b* coefficient gauges a variable's instrumental weight in producing model predictions of case values. The *R* partial correlation indicates an independent variable's *singular* power to determine the behavior of a dependent variable bounded by a set of other independent variables. And added Chi^2 suggests how much each new variable contributes to the *joint* power of a growing multivariate model. Both are provided in the table (which also shows the simple bivariate *Eta* correlation for reference sake), but in the discussion to follow, we will focus on *R*, which holds the most theoretical interest.

According to the table, only 13 of the initial 58 independent variables were accepted for model inclusion, five of which seem to be prime contributing factors: *Four Year Cumulative Grade Point Average* turned out to be the top explanator of student achievement ($R = +.25$); Final GPA also registered one of the highest added Chi^2 values (227). *Attendance during Any Summer Session* showed the second strongest partial correlation with student achievement (+.21) as well as adding a very robust added Chi^2 value (333) to the model. The third highest R was scored by the *Any Change in Major* variable (+.16) which, however, registered only a mid-level added Chi^2 value (90). Following change of major in *R* coefficient importance was *Four Year Always in Good Academic Standing* (+.125) with an added Chi^2 value of only 47. The last of the prime model components was *Four Year Mean Major Term Credit Hour Load* which partial correlated +.10 with Student Achievement and added considerably to the joint Chi^2 (253). All of the above had 0-order correlations of at least .28 with Student Achievement.

The eight remaining table variables all showed Student Achievement absolute partial correlations of under .06. In R correlation order, these were: Completed All Required Remediation by Year 4, Term1-Term2 Mean Credit Load, Any Term1-Term2 Developmental Course-Taking (-), No Major Chosen (-), Term1 Good Academic Standing, Immediate Entry from High School, Enrollment in Hi-Tech or Allied Health Programs, and Younger than 21 Years. First Term Good Standing, however, broke from the pack by registering the highest added Chi^2 (529) of any model variable.

Unfortunately there is no room in this short paper for a thorough exposition of all the statistical patterns revealed in the table. We hope that the following brief observations and conjectures will suffice for the present:

■ Perhaps the most striking finding was the remarkable absence of all but one (Younger than 21 Years) of the social background variables from the model. Neither racial group nor gender nor any of the socio-economic measures available to the logistical regression procedure survived analysis.

■ Moreover, the explanatory weakness of social variables can not be traced to the possible controlling effect of the more achievement-proximate course performance and academic status variables. A separate regression of social background variables only upon student achievement failed to yield a model of reasonable goodness-of-fit and case predictiveness (*-2LL* improvement of only 238 beginning with 2837; cases correctly classified 75 percent, or only 10 percent better than margin-based guessing). However, in other experimental analyses we found that social variables *did* have significant power to explain variation in *particular* intervening variables, especially credit load and remediation need.

■ By type, the single most important block of variables in the achievement model related to student effort and performance (Credit Load, Cumulative GPA and Good Academic Standing). This reflects back upon our earlier cross-tabular findings and subsequent remarks concerning the centrality of simple study and persistence for community college students wishing to progress academically.

■ As already explained, we were precluded by measurement logic from testing the impact of attendance interruption upon student achievement in a regression using the whole cohort database. However, an additional post-first year student only regression allowing for the inclusion of two pattern of attendance variables found that both the Good Start Effect (R = +.12) and Consecutive Major Terms Only variables (R = +.03) made the cut.

■ We were surprised to find that, outside the effort and performance block, two most powerful model elements turned out to be Any Summer Session

Attendance and Any Change of Major, which we initially thought of as minor variables introduced for the sake of comprehensive coverage. These may have functioned as indirect measures of two important psychological factors related to academic success — motivation and flexibility. Summer enrollment may signal the willingness and sense to make up for past failures or to take every opportunity to surge ahead. Changing one's choice of curriculum, similarly, might indicate the capacity to recognize a mistaken path and the courage to set forth on a new, more appropriate road. A change in major may also signify goal clarification which can increase motivation.

■ Remediation status was represented in our model by only two variables — Completed All Developmental Requirements by Year 4 (R = +.05) and Any Developmental Course-Taking Term1-Term2 (R = -.05). None of the many other remediation-related variables satisfied the statistical criteria of the model. Although marginal direct explanators of student achievement, further regression analyses using developmental independent variables only showed them having a fairly robust collective impact upon all three principle course effort and performance variables in the model. The implication is the need for causal modelling such as path analysis to more fully understand the interactions among explanatory variables.

■ Five of the 13 model variables were time-keyed to the first two major terms in the cohort's career. While none of them (except perhaps Term1 Academic Standing) showed a strong degree of model effect, their presence along side parallel variables representing the cohort's complete four year career imply a special role for the "launch period" in conditioning final outcomes. This makes sense when we consider that fully 38 percent of all degree-seeking cohort members ceased attending PGCC before the start of the third major semester.

In conclusion, it must be emphasized that the logistical regression model just presented should be taken as provisional and constitutes only a first step in what will be an on-going cohort-based research effort to uncover the true correlates of student achievement at PGCC. Much work remains to be done in the refinement of both data and methodology. On the data side, we are currently hampered by inadequate information concerning the actual scope of four year school transference from PGCC, a major element of achievement indicator. Given present data sources, our dependent variable misclassifies a small but significant minority of "exiters without transfer, award or sophomore in good standing status" who have actually gone on to Maryland private or out-of-state colleges and universities.

More importantly, although we have ransacked the readily available data sources to put together as comprehensive a set of potential indicators of

academic achievement as possible, we realize that many hypothesized areas of explanation have gone unexplored by our logistical regression work. The ideal data set would be able to measure the achievement impact effects of a much larger range of possible explanators, including: high school performance, pre-college study habits and subject knowledge (e.g., SAT scores); childhood family values (especially educational); student personality (e.g., Myers-Briggs type, emotional dynamics, etc.); personal values, life goals, motivation and drive; social values (ideology, alienation, religion, etc.); customer satisfaction (assessment of college, alternate educational possibilities); job, family, financial and health pressures; social integration with student and institutional life; school social and racial environment; personal capabilities (learning disorders, intelligence quotient, etc.). The linear regression version of our 1990 cohort achievement model explained around half of the dependent variable's total variance. That leaves quite a bit of variance unexplained. OIRA plans to integrate survey-based childhood environment and high school performance data into its achievement modelling of the 1992 cohort behavior.

On the methodological side, OIRA plans to pursue implications of our findings on social background, remedial status and launch period achievement effects by supplementing regression model development with causal path analysis in future research. Even if our current findings had not pointed in this direction, we would have moved to broaden our methodological approach to embrace path analysis. Regression analysis is a superb technique for gauging the impact of *truly* independent variables upon a dependent variable, but is very awkward in dealing with highly inter-correlating explanatory factors. Coincidental collinearity (e.g., as among the various sub-indicators of socio-economic status) can be fairly easily managed in regression analysis through pre-analysis data reduction and scaling. Unfortunately, many of the highly inter-correlating factors behind student achievement are not coincidentally but *structurally* related. Students progress towards their educational goals through an institutional system — the academic *process* — which is a complex of conditional paths by its very nature. In this case, data reduction techniques further muddy already cloudy research waters rather than clarifying them.